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(54) IMPROVED WINDSCREEN WASHING SYSTEM

(71) We, ASSOCIATED ENGINEERING LIMITED, a British Company of 60, Kenilworth Road, Leamington Spa, Warwickshire, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed to be particularly described in and by the following statement:—

The present invention relates to a windscreen washer system for a vehicle.

Difficulty is often encountered in removing persistent marks, such as oil smuts or organic material, with windscreen washer systems using cold water and the present invention is concerned with a windscreen washer system for facilitating the removal of such persistent marks.

From one aspect, the invention consists in a windscreen washer system for a vehicle, comprising a heat-insulated reservoir for screenwash liquid, a heat-exchange device associated with said reservoir and being arranged for connection to the engine cooling system of a vehicle, whereby screenwash liquid in said reservoir can be heated by heat derived from the engine coolant when the engine is operated and the heated screenwash liquid stored in said reservoir, and means to supply said heated screen-wash liquid to the vehicle windscreen.

The heat exchanger device may be arranged to be connected in the top radiator hose of the engine cooling system or for location in a conduit of the engine cooling system in heat exchange contact with the screenwash liquid in the reservoir.

The reservoir itself may be made from a heat insulating material or the reservoir may be lagged or otherwise insulated to retain heat.

From a further aspect, the invention consists in a windscreen washer system for a vehicle having an engine cooling system including liquid coolant, said system comprising a reservoir for screenwash liquid, which reservoir is thermally insulating, means to supply said screenwash liquid to the vehicle windscreen, a heat-exchange device located to be in heat-exchange contact with said screenwash liquid and being arranged for connection to said engine cooling system to receive, when the engine is operated, liquid coolant at a temperature above ambient temperature whereby screenwash liquid in said reservoir can be heated and the heated screenwash liquid stored therein, and a thermostat device responsive to the temperature of said screenwash liquid, and connected to control heat transfer to the screenwash liquid from said heat-exchange device and thereby prevent boiling of said screenwash liquid.

In a preferred embodiment of the invention, the thermostat device is connected to reduce or interrupt flow of coolant through the heat exchange device when a predetermined maximum temperature is exceeded and is located within said reservoir, to be responsive to the temperature of screenwash liquid in said reservoir.

In another embodiment of the invention, a second reservoir is connected to feed the said reservoir with liquid when liquid is withdrawn therefrom for screen washing.

The means for feeding heated liquid to the vehicle windscreen may include a pump which may be manually or electrically operated. Where a heat exchange device and a manually-operated pump are used however the first reservoir should be so positioned to allow thermal siphoning as occurs for example in a domestic hot water system.

One or more dispensers may be provided for introducing controlled amounts of additives, such as anti-freeze or detergent, into the system. The additive dispensers may be situated either upstream or downstream of the reservoir or when there are two reservoirs may be situated therebetween.

The invention also consists in a vehicle including any of the windscreen washer system defined hereinabove.

The invention will now be further described by way of example with reference to the accompanying drawings in which:—

Figures 1 to 3 and 5 are diagrammatic

illustrations showing different embodiments of windscreen washer systems constructed according to the present invention, and

Figure 4 illustrates a control circuit forming part of each of the systems of Figures 1 to 3, and

Figures 6 to 8 show various ways in which the systems of Figures 1 to 3 and 5 direct screenwash liquid on to a windscreen of a vehicle.

Referring to Figure 1, cold and hot water reservoirs are designated 10 and 12 respectively. In this specification "hot" may be defined as a temperature which is substantially above atmospheric temperature during normal operation. The hot water reservoir is made from a heat insulating material for example from a suitable glass, is heat insulated by external insulation such as lagging or is otherwise insulated to retain heat. Water is collected from a surface of the vehicle to which the system is fitted such as a vehicle bonnet or boot (not shown) through a suitable collector, diagrammatically illustrated at 11, and led from the collector 11 through a pipe 14 into the cold water reservoir 10. A dispenser 16 containing anti-freeze additive, and a venturi metering device 18 are connected in the pipe 14 so that as water passes along the pipe 14 towards the reservoir 10 a controlled amount of anti-freeze is introduced into the pipe by way of the metering device 18.

A further pipe 20 connects the cold and hot water reservoirs and siphons water from the cold water reservoir into the hot water reservoir when water is withdrawn from the hot water reservoir. A diffuser 22 is provided on the hot water end of the pipe 20 and prevents cold water stirring and cooling the outlet hot water when the cold water enters the hot water reservoir. A non-return valve (not shown) may be provided to prevent cold water filtering back to the cold reservoir. A further pipe or conduit 24 leads from the hot water reservoir ultimately to the screen washer jets. Disposed along the conduit 24 are an electric pump 26, a solenoid-operated change-over valve 28 and a dispenser 30 which is arranged to dispense controlled amounts of detergent additive into the conduit 24 through a venturi metering device 32. The valve 28 is connected through a pipe 34 to a heat exchange device 36 located in the vehicle top radiator hose or conduit 25. A return pipe 38 from the heat exchanger leads to the hot water reservoir 12 thus enabling water stored in the reservoir 12 to be circulated through the heat exchanger. The end of the pipe 38 includes a filter 40.

When the vehicle fitted with the system is started from cold, the water in the reservoir 12 may be still hot from a previous vehicle run. Hence, if the driver wishes to use the screen washer immediately, for example to de-frost his screen, a supply of hot screen wash water is immediately available. As the engine cooling water temperature rises, at about 50°C a thermostat switch 42 in the heat exchanger 36 closes, and energises the pump 26 to enable the water to be circulated between the heat exchanger and the hot water reservoir if the reservoir temperature is low enough for a thermostat switch 44 provided within the hot water reservoir also to be closed (which it will be unless the previous vehicle run was fairly recent). The thermostat 44 controls heat transfer from the heat exchange device 36 as follows. Once the water temperature in the reservoir 12 reaches a temperature of about 80°C the thermostat 44, operates to cut-off the electrical supply to the pump 26 and thus interrupt the flow of water through the heat exchange device 36 to prevent boiling of the hot water.

In the systems of Figures 2 and 3 similar reference numerals refer to similar parts with those of Figure 1. The system of Fig. 2 differs from that of Fig. 1 in that the detergent receiver 30 is disposed between the cold and hot water reservoirs so that detergent is metered into cold water as it is transferred to the hot water reservoir and water is added direct to the reservoir 10. Alternatively water could be supplied to the reservoir 10 from the collector 11 and pipe 14 of Figures 1 and 3. The cold water reservoir may be insulated to prevent freezing or anti-freeze may be added from a dispenser as was described with reference to Figure 1.

The system of Fig. 3 differs from that of Figure 1 in that a combined detergent and anti-freeze dispenser 50 and meter 52 are provided upstream of the cold water reservoir.

Referring now to Figure 4 the vehicle battery is designated 46 and is connected in series circuit with the washer pump 26 and the two thermostats 42 and 44. A double pole switch 48 has one set of contacts connected in parallel with the two thermostats and the other sets of contacts connected through the solenoid of the valve 28 into the circuit between the vehicle battery and the washer pump.

When it is desired to operate any of the systems of Figs. 1 to 3, the switch 48 is closed by the driver and this both energises the pump 26, if it is not already energised by the thermostats 42, 44 and the solenoid-operated valve 28. Hence pipe 34 is disconnected from, and pipe 24 is connected to, the pump circuit so that heated water and additive is free to pass along pipe circuit 24 to the screen washer jet or jets. When the switch 48 is opened by the driver the solenoid is denergized and the valve 28 connects

the pump circuit to the heat exchange device 36 via the pipe 34.

The quantities of additive dispensed by the dispensers 16 and 30 of Figure 1, dispenser 30 of Figure 2 and dispenser 50 of Figure 3 can be adjusted in dependence upon vehicle operating conditions. For example in the summer months the dispensers 16 and 50 would not be charged with anti-freeze and in the winter months the quantity of anti-freeze dispensed can be increased during periods of extreme cold. Moreover, instead of collecting water from a surface of the vehicle, water may be added direct to the cold water reservoir 10.

As a still further alternative, the thermostats may be replaced by an alternative regulating device such as a thermistor control circuit.

One advantage of the systems of Figures 1 to 3 is that the two reservoirs prevent the temperature of the incoming water from affecting the water in the hot water reservoir.

The embodiment of Figure 5 differs from those of Figs. 1 to 3 primarily in that the reservoir 10 is omitted and the heat exchange device is disposed within the reservoir 12 there being no need for a solenoid valve 28 and pump circuit such as is described in Figures 1 to 4.

Referring now to Figure 5, the hot water reservoir 12 is provided with a screw filler cap 13, or the like. A conduit 24 leads from the hot water reservoir 12, via a suitable pump 23 which may be electrically operated, to the screen-washer jets. Within the reservoir 12 there is provided a heat exchange device constituted by a metal coil 27, e.g. of copper, in parallel with a heater 29 of a vehicle. The coil 27 is immersed in the screenwash liquid when the reservoir is full. When the screenwash liquid is cold hot engine coolant flows from the engine via a conduit 33 through the coil 27 and back to the engine via conduit 35 as well as through the vehicle heater 29. The conduits 33 and 35 are connected by suitable fittings to the heater conduits 37 and 39 leading from and back to the engine respectively. Within the reservoir 12 is located a thermostat valve 31 which is positioned in the coil 27 near the lowest point of the reservoir 12. The thermostat device is responsive to the temperature of the screenwash liquid in the reservoir, and is set to control heat transfer from the coil 27 by reducing or interrupting the flow of engine coolant through the coil 27 — the latter causing the full flow to pass through the heater 29 — when the temperature of the screenwash liquid in the reservoir 12 reaches, say, 80°C thereby to prevent boiling of the screenwash liquid. The thermostat 31 will have a suitable hysteresis so that it opens again when the screenwash liquid temperature has fallen by, say, 10°C.

The inlet to conduit 24, which is near the bottom of the reservoir 12, is preferably fitted with a filter 40.

Additive dispensers such as 16, 30, 50 and their associated metering devices may be connected in the system of Figure 5 if so desired.

Alternatively or in addition, to direct filling of the reservoir 12 with screenwash liquid, water may be collected, as by the collector 11 of Figs. 1 and 3, from a surface of the vehicle and led into the reservoir by a suitable pipe which would pass through an aperture in suitable closure means or in the cap 13. As an alternative, the vehicle radiator may replace the heater 29.

Referring to Figures 6 and 7 the liquid supplied to the windscreen 41 of a vehicle 43 along conduit 24 of any of Figures 1 to 3 and 5 can be fed as shown in Figure 6 from jets 45 mounted under the screen or alternatively as shown in Figure 7 from a pipe 47 attached to each wiper arm 49 of the windscreen wipers of which only one windscreen wiper 51 is shown. With the jets 45 mounted below the screen 41 however, the water jet must be swept by the wiper arms 49 from the position where it strikes the screen to clean the area wiped by the wiper blade 52. When the water is supplied from the pipe 47 attached to the wiper arms 49 it is fed from one side of the blade 52. In this way the water is not wiped away when the arm is moving in the direction in which the blade precedes the water. It is preferable therefore to pump water only when the water precedes the blade. This can be done by means of a commutator switch on the wiper motor spindle which is arranged in series with the pump supply.

It may be advantageous as shown in Figure 8 to fix a sponge 53 alongside the or each wiper 51, through which water may be fed to the screen. Hence a double wiping action is provided when the sponge precedes the wiper. A mechanism (not shown) may be used to raise the sponge 52 on the return stroke of the wiper. The mechanism may take the form of a cam, operatively connected to the motor spindle and arranged to displace a Bowden cable at selected positions. The sheath at the other end of the Bowden cable may be attached by a bracket to a wiper arm 49 and the free end of the cable connected to a clamp which carries the sponge 52. Hence during a return stroke, the sponge is lifted from the windscreen 41.

Alternatively a solenoid-operated valve may be provided on the or each wiper, the solenoid being actuated, deactuated by a pair of limit switches positioned adjacent each end of the wiper stroke. The limit switches are used to operate a latching relay

to hold the sponge down when required. Alternatively a commutator switch could be used.

A still further alternative (not shown) is to fix a sponge to either side of the wiper blade so that the sponge wipes the screen before the blade in both directions of movement. The sponge 53 in Figure 8 or sponges can if required be fed with water through holes in a hollow wiper blade and a simple valve arrangement can be used to supply water only to that side of the blade in contact with the screen.

It will be appreciated that the arrangements of Figures 6 to 8 are applicable to a single windscreen wiper arrangement, for example, for the rear windscreen of an automotive vehicle.

WHAT WE CLAIM IS:—

1. A windscreen washer system for a vehicle, comprising a heat-insulated reservoir for screenwash liquid, a heat-exchange device associated with said reservoir and being arranged for connection to the engine cooling system of a vehicle, whereby screenwash liquid in said reservoir can be heated by heat derived from the engine coolant when the engine is operated and the heated screenwash liquid stored in said reservoir, and means to supply said heated screenwash liquid to the vehicle windscreen.

2. A windscreen washer system as claimed in claim 1, in which the heat exchange device is arranged for location in a conduit of the engine cooling system of a vehicle to be in heat exchange contact with the screenwash liquid.

3. A windscreen washer system as claimed in claim 1, in which said heat exchange device is positioned within said reservoir to be in heat exchange contact with the screen wash liquid.

4. A windscreen washer system for a vehicle having an engine cooling system including liquid coolant, said system comprising a reservoir for screenwash liquid, which reservoir is thermally insulating, means to supply said screenwash liquid to the vehicle windscreen, a heat-exchange device located to be in heat-exchange contact with said screenwash liquid and being arranged for connection to said engine cooling system to receive, when the engine is operated, liquid coolant at a temperature above ambient temperature whereby screenwash liquid in said reservoir can be heated and the heated screen wash liquid stored therein, and a thermostat device responsive to the temperature of said screenwash liquid, and connected to control heat transfer to the screenwash liquid from said heat-exchange device and thereby prevent boiling of said screenwash liquid.

5. A windscreen washer system as claimed in claim 4, in which said thermostat device is connected to reduce or interrupt flow of coolant through the heat exchange device when a predetermined maximum temperature is exceeded and is located within said reservoir to be responsive to the temperature of screenwash liquid in said reservoir.

6. A windscreen washer system as claimed in claim 4 in which the heat exchange device is connected to be supplied with screenwash liquid from said reservoir to heat the supplied screenwash liquid and wherein a thermostat device is connected to interrupt the flow of screenwash liquid through the heat exchange device when a predetermined mavimum temperature is exceeded and is located within said reservoir to be responsive to the temperature of screenwash liquid in said reservoir.

7. A windscreen washer system as claimed in any preceding claim, including a second reservoir connected to feed unheated screenwash liquid to the said reservoir.

8. A windscreen washer system as claimed in any of claims 1 to 6, or claim 7, including means for collecting water from a surface of the vehicle and means for feeding the water being collected to the said or the second reservoir.

9. A windscreen washer system as claimed in any preceding claim including a screen washer jet or jets attached to the windscreen wiper arm or arms.

10. A windscreen washer system as claimed in claim 9, in which the jet or jets are arranged to supply liquid from only one side of a wiper blade at a time.

11. A windscreen washer system as claimed in any preceding claim, in which a sponge is provided on one or both sides of a wiper blade, through which liquid can be fed to the screen.

12. A windscreen washer system as claimed in claim 11, in which a mechanism is provided for raising the or each sponge on the return stroke of the wiper blade.

13. A windscreen washer system as clamied in claim 11 or 12, in which the wiper blade is hollow and provided with one or more holes through which liquid can be fed to the or each sponge.

14. A windscreen washer system substantially as hereinbefore described with reference to Figures 1 and 4 and any one of Figures 6 to 8 of the accompanying drawings.

15. A windscreen washer system substantially as hereinbefore described with reference to Figures 2 and 4 and any one of Figures 6 to 8 of the accompanying drawings.

16. A windscreen washer system substantially as hereinbefore described with refer-

ence to Figures 3 and 4 and any one of Figures 6 to 8 of the accompanying drawings.

17. A windscreen washer system substantially as hereinbefore described with reference to Figure 5 of the accompanying drawings.

18. A windscreen washer system substantially as hereinbefore described with reference to Figure 5 and any one of Figures 6 to 8 of the accompanying drawings.

19. A vehicle including a windscreen washer system as claimed in any preceding claim.

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1451666 COMPLETE SPECIFICATION

5 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 1

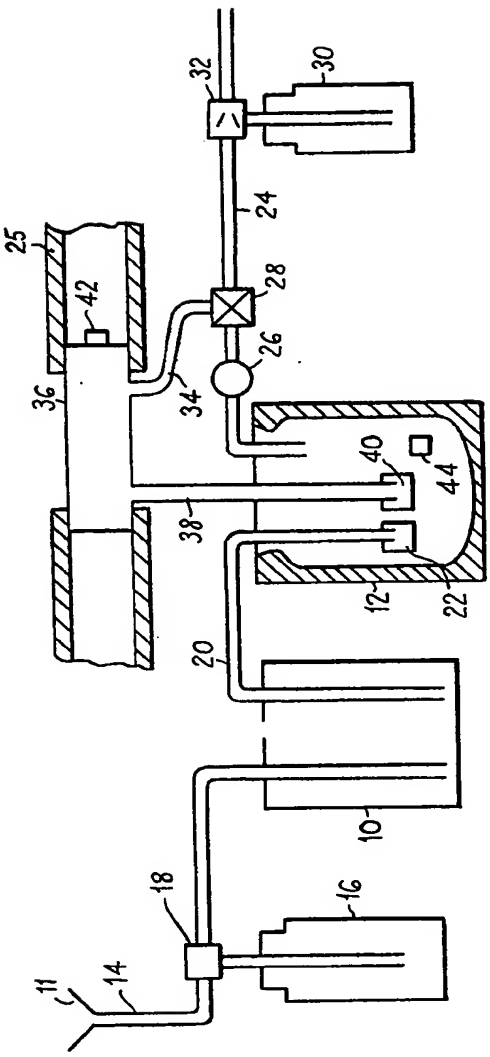

Fig.1

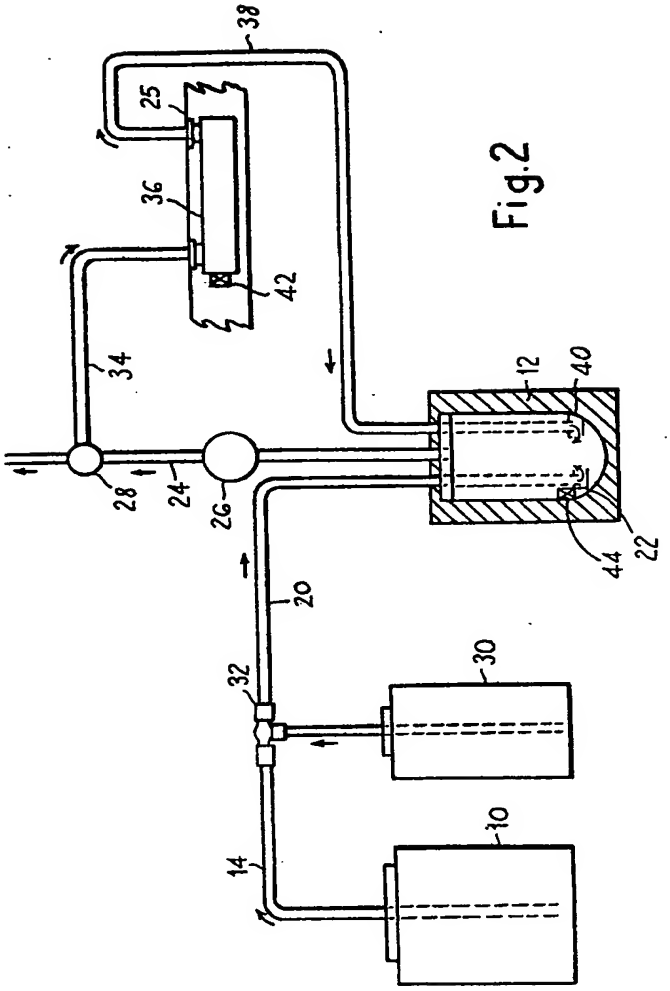

Fig.2

1451666 COMPLETE SPECIFICATION
5 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 3

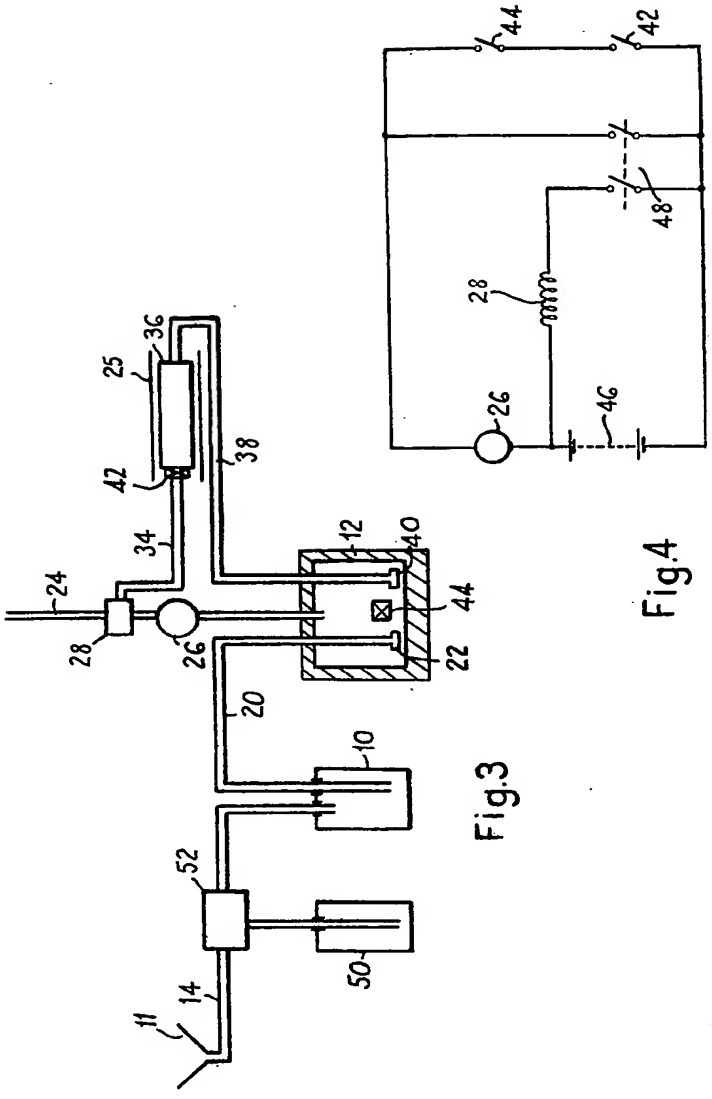

Fig.4

Fig.3

Fig.5

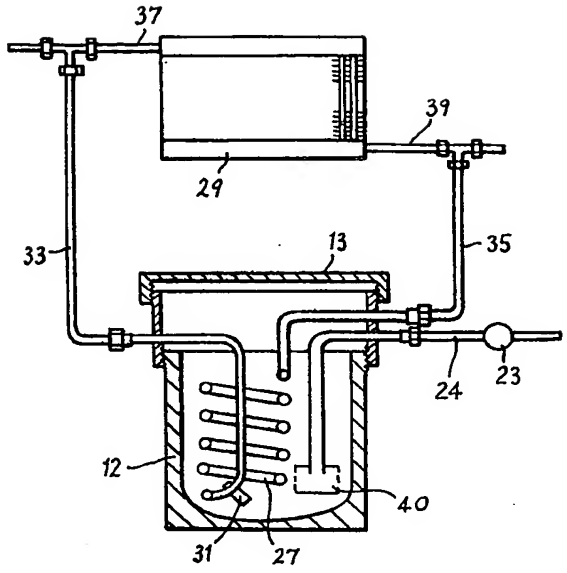

Fig.6

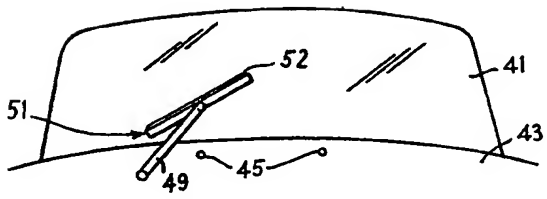

Fig.7

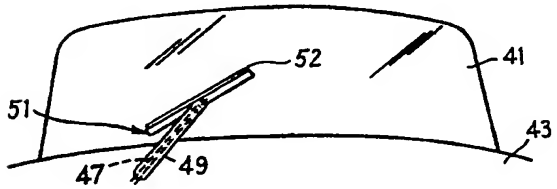

Fig.8